

By taking advantage also of the bright planets passing the meridian in the day time good observations can be obtained for latitude and longitude *at the same time* (a great point), whilst the sun is above the horizon, as well as at sunrise and sunset, when by Sumner's method three or more stars can be combined to give the position. We admit that constant practice is required to take these observations accurately, but they *can* be obtained, and as it is very useful to be able to make certain of a ship's position, as often as possible, all officers should practise themselves in observing both Venus and Jupiter with the sun above the horizon.

Whilst however not agreeing with Capt. Wharton on some few points, we think his work will be found most useful, not only for young officers taking up surveying but also as a book of reference for older surveyors, and personally feel much obliged to him for combining in one volume so many useful remarks and tables which have hitherto been only in MSS. or pamphlets.

THE HORSE IN MOTION

The Horse in Motion as shown by Instantaneous Photography; with a Study on Animal Mechanics, founded on Anatomy and the Revelations of the Camera, in which is demonstrated the Theory of Quadrupedal Locomotion. By J. D. B. Stillman, M.A., M.D. Executed and Published under the Auspices of Leland Stanford. (London: Trübner and Co., 1882.)

THE above is the somewhat long title of a large and important work issuing from the well-known Cambridge (U.S.) University Press. Long as is the title, the name of the principal contributor to the volume is left unrecorded there, though indeed even a cursory glance over its contents shows how much indebted is the whole question of the mode of motion in the horse to the elaborate series of investigations of Mr. J. Muybridge.

Leaving aside the anatomical and telegraphic arguments of Dr. Stillman, as contained in some hundred pages of letterpress, we cull from a postscript to the same the following interesting information, which we give as we find it in the book. Some time in 1872, Mr. L. Stanford, of Palo Alto Farm, in California, had his attention called to the very controverted question as to the action of a trotting horse, and conceiving the idea that the photographic camera might be made available to illustrate the action, he, according to the authority before us, consulted with Mr. Muybridge and induced him to undertake some experiments in instantaneous photography. Some ten years ago, a photograph taken in the space of the one-twelfth of a second was considered quite a success, and it would seem that the experiments made then by Mr. Muybridge were inconclusive. In 1877 Mr. Muybridge, however, renewed his experiments. A few pictures were taken of "Occident," a noted trotter belonging to Mr. Stanford, while he was in motion, and one of these, representing the horse with all his feet clear of the ground was enlarged, retouched, and distributed. This result was so extraordinary and so successful, that it was determined to try others on a more extended scale. It was assumed that if one picture could be taken instantaneously, an indefinite number might also be taken, and so the various positions assumed by the horse in a single complete stride could be illustrated.

Mr. Muybridge was authorised to procure the needed apparatus, and a building suitable to the purpose was erected on Mr. Stanford's farm. By 1878 preparations were complete, and every resource of the photographic art had been provided. Twelve cameras were placed in the building at intervals of twenty-one inches, with double shutters to each, and these shutters were so arranged that the whole series of exposures were made in the time occupied by a single complete stride of a horse. The very ingenious mechanism invented by Mr. Muybridge it would be impossible to describe without the assistance of illustrations, but it may be stated that he was thereby enabled to double the number of his cameras, and the whole of the large series of twenty-four figures each, which are used to illustrate this volume, were taken by him. They were very accurately taken, and the heliotypes are perfect transcripts of the original photographs.

Thanks to the zeal and energy of Mr. Muybridge, and the liberality of Mr. Stanford, we are now enabled to see for ourselves the various attitudes assumed by a horse in running, trotting, leaping, and the result is most strange. It would seem as if most civilised nations had failed to recognise the true action of this noble quadruped, as if all had settled down into being content with a conventional idea of how a horse in motion ought to be represented. Now our artists will have no excuse; they can directly interrogate nature, as represented to them in these silhouettes, no doubt at first they may follow her with fear, for some of the positions look strange, not to say grotesque, but soon both artist and the public will have learnt to recognise the truth: and once this is so, the old style will be in its turn regarded as grotesque, and as representing but an early stage in the development of art.

Mr. Muybridge's photographs will be of immense importance to all art students, and they should be attentively studied by all admirers of the horse. A few other photographs are given in this volume of the various stages of motion in the cow, dog, deer, and boar.

OUR BOOK SHELF

Unexplored Báluchistán: a Survey of a Route through Mekerán, Bashkurd, Persia, Turkistan, and Turkey. By Ernest A. Floyer. (London: Griffith and Farran, 1882.)

AN entertaining book of travel, but by no means an exploration of "Unexplored Báluchistán," as is indeed sufficiently evident from the sub-title. Nevertheless, Mr. Floyer has investigated and partly solved some interesting geographical questions in the little-known province of Bashkurd (Bashakard), on the Perso-Mekrán frontier, which he visited on two separate occasions during the years 1876-7. This region, which had been merely skirted by Goldsmid, Lovett, Ewen Smith, St. John, and others connected with the Perso-Bálúch Boundary Commission of 1872, and with the development of telegraphy in Persia and Mekrán in 1873-4, was ascertained to comprise six separate territories or districts—Gavr and Parment in the east, Jagda in the west, Marz and Pizgh north and south respectively, and Daroserd with the capital, Angurhán, in the centre. The town, which appears to be a place of great natural strength, was found to lie in 26° 40' N. lat., 57° 55' E. long., or about thirty miles from the position assigned to it on Major St. John's map. The Aphe-i-Band range, between Daroserd and Pizgh, was crossed near its western extremity, and ascertained to run east and west under 26° 30' N., at a mean elevation of 3600

feet, the culminating point of the whole province being apparently the Gu-Koh peak (6,400 feet) in the Parment district.

A survey of the Ab-washur water-parting, between Bashkurd and Hormuz Strait, considerably reduced the supposed eastward extension of the Mináb basin, and showed conclusively that it was in no way connected with the Bampur River, which many geographers have hitherto made to discharge through the Mináb into the Persian Gulf. Mr. Floyer now argues with much force that the true outlet of the Bampur is the Sadích (Sadaich), which reaches the coast in $58^{\circ} 40'$ E., in the Gulf of Omán, and which seems to flow from the Shahri country, through the Shimsani Pass, in the Band-i-Marz range. He found that where he crossed the Haliri in 28° N., $57^{\circ} 40'$ E., it was already a considerable stream, 90 feet broad, and $4\frac{1}{2}$ feet deep. The furthest head-waters of this important river, of which next to nothing was previously known, are in the Jemal Bariz range, whence it flows in a south-easterly direction to the Rudbar and Shahri districts. Here it would be almost necessarily joined by the Bampur River, coming from the north-east, and the united stream, whose further course has hitherto remained an unsolved problem, would appear to flow thence through the Shimsani Pass southwards to the Sadích. Hence the Sadích would seem to be the lower course of the Haliri-Bampur, thus draining nearly the whole of the region in south-east Persia, between 57° – 61° E., and $25^{\circ} 30'$ – 29° N. But this interesting point cannot, of course, be finally determined without a more thorough exploration of the Rudbar and Shahri districts between Bampur and the Ab-washur water-parting.

The work, whose chief fault is its misleading title, is written in a pleasant, vivacious style, and contains much useful information touching the ethnical, social, and linguistic relations of the Balúchi tribes on the Perso-Mekrán frontier.

A. H. KEANE

A Synopsis of Elementary Results in Pure and Applied Mathematics: containing Propositions, Formulae, and Methods of Analysis, with Abridged Demonstrations. By G. S. Carr, B.A. Vol. i., Section ix. (London: C. F. Hodgson and Son, 1882.)

In our notices of the previous sections we have sufficiently indicated the scope of this work. The present section is devoted to the integral calculus, and takes up its numbered articles at 1900, and closes at 2997: the pagination being pp. 313–440 of part ii. of vol. i. The same honest work, for which we have already commended the author, is conspicuous here, and the utility of having such a handy manual on the calculus is evident. It would be impossible to furnish here the results of a thorough examination of the text; the preparation for such a task would take up a very long time; but we would recommend a testing of the several parts to which a reader may have occasion frequently to refer, so that the book might be consulted with full confidence. We are glad to find that the likelihood of the occurrence of such errors as we mentioned in our notice of the first part, is reduced to a minimum by the very careful method of revision now adopted by Mr. Carr. We have much pleasure in commending this new section to the notice of our mathematical readers.

A Collection of Examples and Problems on Conics and some of the Higher Plane Curves. By Ralph A. Roberts, M.A. (Dublin: Hodges, Figgis, and Co., 1882.)

THESE Examples will serve as an excellent compendium of results to a student who is working through Dr. Salmon's Treatises on Conic Sections and on the Higher Plane Curves. In fact it was whilst the author was reading the above-named works that he conceived these useful illustrative exercises. Mr. Roberts shows himself to be

an apt mathematician, and to have a very extensive acquaintance with the classes of curves considered. These are mostly curves of the second, third, and fourth orders. The Problems have been, in general, suggested by Dr. Salmon's treatises and by Dr. Casey's Memoir on Bicircular Quartics: Mr. Roberts also acknowledges his indebtedness to Darboux's *Sur une classe remarquable de courbes et de surfaces algébriques*. Occasional explanatory matter is thrown in here and there, and concise proofs are given in several cases. As the text-books contain a limited number of examples, this work will be a useful supplement to them. We like almost everything about the book except the paper, and that appears to us to be of a very inferior character.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

The Recent Unseasonable Weather

IN view of the recent unusually cold weather in England and Scotland, which has been so well described and proximately explained in last week's NATURE, the following paragraph, extracted from the *Standard* of June 15, appears to me highly suggestive, especially as regards one of the probable causes for the "unwonted high pressures" on the northern side of the depression which is accused of being the immediate source of these unseasonable conditions:—

"News from Iceland states that the Spitzbergen floe-ice surrounds the north and east coast, entirely preventing navigation. A Norwegian steamer endeavouring to reach Bernfjord, on the south-east coast, last week, was caught in the ice and had to put back. Owing to the presence of these immense ice-fields vegetation has made no progress, causing a great loss of horses and sheep through starvation. Epidemics of measles and small-pox have been introduced into the island from Europe, and are making extensive ravages among the population; the former is especially prevalent in Reykjavik."

Now it has been ascertained with some considerable degree of certainty by Messrs. Blanford and Eliot, the Government meteorologists in India, that a heavy winter snowfall over the North-west Himalaya exercises a marked and prolonged influence in lowering the temperature and elevating the atmospheric pressure and thereby directly affecting the winds and weather, over the whole of Northern India, and parts of Central India; and indirectly to a much greater distance. Turning to Europe, we find the distance from Reykjavik, on the west coast of Iceland to London is about 1140 miles, or about the same as from Lahore to Calcutta (1080 miles), while from Cape Horn on the east coast of Iceland to Edinburgh the distance is only 750 miles, or about the same as from Calcutta to Agra. To any one familiar with Indian weather charts or the meteorology of that country, it would appear absurd not to attempt to correlate the meteorological conditions at places so comparatively near as the above-mentioned towns; and in fact experience has shown that the meteorology of the Punjab is not only intimately connected with that of Lower Bengal, but also with that of Southern India. If therefore it has been found that an abnormally heavy snowfall in the North-West Himalaya, such as that which characterised the winters of 1876–77 and 1877–78, exercised a marked effect on the meteorology of Northern India, which was felt at places situated 1000 miles or more from the seat of action, may it not be reasonably inferred that the presence of a large mass of ice or snow in the Icelandic area would be likely to give rise to similar atmospheric conditions over these islands? It seems therefore not at all improbable, that the abnormal weather during the past few weeks may be directly due in some considerable measure to the coincident appearance of large masses of ice off the eastern coasts of Iceland, like those which, from the account in the *Standard*, appear to be at present prevailing to an unusual extent.

In the case of India an abnormally heavy fall of snow in the